PYRAMID GEOPHYSICS

PYRAMID GEOPHYSICAL SERVICES
(PROJECT 2017-253)

GEOPHYSICAL SURVEY

METALLIC UST INVESTIGATION:
PARCEL 1
NCDOT PROJECT P-5705B (44475.1.2)

301 N. SMITH ST., CHARLOTTE, NC

SEPTEMBER 14, 2017

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GEOPHYSICAL INVESTIGATION REPORT
Parcel 1 – 301 N. Smith St.
Charlotte, Mecklenburg County, North Carolina

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LIST OF ACRONYMS

CADD .....Computer Assisted Drafting and Design
DF .....Dual Frequency
EM.....Electromagnetic
GPR.....Ground Penetrating Radar
GPS .....Global Positioning System
NCDOT.....North Carolina Department of Transportation
ROW .....Right-of-Way
UST .....Underground Storage Tank

EXECUTIVE SUMMARY

Project Description: Pyramid Environmental conducted a geophysical investigation for the North Carolina Department of Transportation (NCDOT) at Parcel 1, located at 301 N. Smith St., Charlotte, NC. The survey was part of an NCDOT Right-of-Way (ROW) investigation (NCDOT Project P-5705B). The survey was designed to include the location of a suspected UST (oil-water separator) identified by a previous geophysical survey (report dated April 11, 2003) as well as the immediate surrounding area. Conducted from August 26-29, 2017, the geophysical investigation was performed to determine if unknown, metallic underground storage tanks (USTs) were present beneath the survey area.

Geophysical Results: The geophysical investigation consisted of electromagnetic (EM) induction-metal detection and ground penetrating radar (GPR) surveys. A total of six EM anomalies were identified. A metal anomaly associated with a concrete pad was suspected to be the result of metal reinforcement in the concrete, but was investigated with GPR to verify. Three other metallic features were also investigated with GPR.

GPR verified the presence of metal reinforcement in the concrete pad. GPR also provided evidence of an isolated, discreet lateral reflector in the central portion of the survey area that is characteristic of a structure such as an oil-water separator UST. The combined geophysical data resulted in this feature being classified as one possible metallic UST (center point: 1448878, 545047, North Carolina State Plane NAD83, feet). The possible metallic UST was approximately 9 feet long and 3 feet wide, located directly below the asphalt subgrade. The remaining geophysical data provided evidence of a possible utility east of the possible UST, and an area containing suspected metallic debris.

Collectively, the geophysical data recorded evidence of one possible metallic UST at Parcel 1.

INTRODUCTION

Pyramid Environmental conducted a geophysical investigation for the North Carolina Department of Transportation (NCDOT) at Parcel 1, located at 301 N. Smith St., Charlotte, NC. The survey was part of an NCDOT Right-of-Way (ROW) investigation (NCDOT Project P-5705B). The survey was designed to include the location of a suspected UST (oil-water separator) identified by a previous geophysical survey (report dated April 11, 2003) as well as the immediate surrounding area. Conducted from August 26-29, 2017, the geophysical investigation was performed to determine if unknown, metallic underground storage tanks (USTs) were present beneath the survey area.

The site included an asphalt parking lot with a zone of concrete and several parking barriers. An aerial photograph showing the survey area boundaries and ground-level photographs are shown in **Figure 1**.

FIELD METHODOLOGY

The geophysical investigation consisted of electromagnetic (EM) induction-metal detection and ground penetrating radar (GPR) surveys. Pyramid collected the EM data using a Geonics EM61 metal detector integrated with a Trimble AG-114 GPS antenna. The integrated GPS system allows the location of the instrument to be recorded in real-time during data collection, resulting in an EM data set that is geo-referenced and can be overlain on aerial photographs and CADD drawings. A boundary grid was established around the perimeter of the site with marks every 10 feet to maintain orientation of the instrument throughout the survey and assure complete coverage of the area.

According to the instrument specifications, the EM61 can detect a metal drum down to a maximum depth of approximately 8 feet. Smaller objects (1-foot or less in size) can be detected to a maximum depth of 4 to 5 feet. The EM61 data were digitally collected at approximately 0.8-foot intervals along north-south trending or east-west trending, generally parallel survey lines, spaced five feet apart. The data were downloaded to a

computer and reviewed in the field and office using the Geonics NAV61 and Surfer for Windows Version 14.0 software programs.

GPR data were acquired across select EM anomalies on August 27-29, 2017, using a Geophysical Survey Systems, Inc. (GSSI) UtilityScan DF unit equipped with a dual frequency 300/800 MHz antenna. Data were collected both in reconnaissance fashion as well as along formal transect lines across EM features. The GPR data were viewed in real-time using a vertical scan of 512 samples, at a rate of 48 scans per second. GPR data were viewed down to a maximum depth of approximately 6 feet, based on dielectric constants calculated by the DF unit in the field during the reconnaissance scans. GPR transects across specific anomalies were saved to the hard drive of the DF unit for post-processing and figure generation.

Pyramid's classifications of USTs for the purposes of this report are based directly on the geophysical UST ratings provided by the NCDOT. These ratings are as follows:

Geophysical Surveys for Underground Storage Tanks on NCDOT Projects

High Confidence	Intermediate Confidence	Low Confidence	No Confidence
Known UST Active tank - spatial location, orientation, and approximate depth determined by geophysics.	**Probable UST** Sufficient geophysical data from both magnetic and radar surveys that is characteristic of a tank. Interpretation may be supported by physical evidence such as fill/vent pipe, metal cover plate, asphalt/concrete patch, etc.	**Possible UST** Sufficient geophysical data from either magnetic or radar surveys that is characteristic of a tank. Additional data is not sufficient enough to confirm or deny the presence of a UST.	Anomaly noted but not characteristic of a UST. Should be noted in the text and may be called out in the figures at the geophysicist's discretion.

DISCUSSION OF RESULTS

Discussion of EM Results

A contour plot of the EM61 results obtained across the survey area at the property is presented in **Figure 2**. Each EM anomaly is numbered for reference in the figure. The following table presents the list of EM anomalies and the cause of the metallic response, if known:

LIST OF METALLIC ANOMALIES IDENTIFIED BY EM SURVEY

Metallic Anomaly #	Cause of Anomaly	Investigated with GPR
1	Reinforced concrete	☑
2	**One possible UST**	☑
3	Suspected utility	☑
4	Vehicles	
5	Unknown buried metal	☑

EM Anomaly 1 was suspected to be the result of metal reinforcement within the concrete pad visible in the parking lot. A second high-amplitude anomaly (Anomaly 2) adjacent to the concrete was suggestive of a UST, and also correlated to the location of the suspected oil-water separator in the previous geophysical investigation. Anomaly 3 was suspected to be associated with a utility due to its linear orientation. Anomaly 4 was the result of vehicles parked adjacent to the survey area. Anomaly 5 was associated with unknown buried metal. GPR was performed to further investigate Anomalies 1, 2, 3 and 5.

Discussion of GPR Results

Figure 3 presents the locations of the formal GPR transects performed at the property, as well as select transect images. A total of sixteen GPR transects were performed at the site. All of the transect images are included in **Appendix A**. GPR Transects 1-8 were performed in a grid-like fashion across the concrete pad suspected to contain metal reinforcement. These transects verified the presence of metal reinforcement in the concrete. No evidence of any larger structures such as USTs was observed beneath the reinforcement.

GPR Transects 9-10 were performed across EM Anomaly 5. No evidence of any clear structures was observed at this location. It is likely this metallic anomaly is associated with buried debris.

GPR Transects 11-13 were performed across EM Anomaly 2, directly east of the concrete pad. This location correlated to the suspected oil-water separator in a previous geophysical report. These transects recorded an isolated flat lateral reflector that is consistent with the top of a vault-type structure such as an oil-water separator. The combined geophysical

data result in this feature being classified as one possible UST (center point: 1448878, 545047, North Carolina State Plane NAD83, feet). The possible UST was approximately 9 feet long and 3 feet wide, and was directly below the asphalt surface.

GPR Transects 14-16 were performed across the suspected utility, east of the possible UST (Anomaly 3). Depth penetration was poor in this area, and no clear evidence of a utility was evidenced in the GPR data. However, the NCDOT MicroStation plans show an unknown utility at this location. This information, combined with the metal anomaly, suggest that this feature is associated with a buried utility. Its size and orientation are not consistent with a structure such as a UST.

Figure 4 presents the location of the possible UST on an aerial photograph along with a ground-level photograph.

Collectively, the geophysical data recorded evidence of one possible metallic UST at Parcel 1. The shape of the feature, in conjunction with information from a previous geophysical report, suggests that this structure may be an oil-water separator.

Figure 5 provides an overlay of the geophysical survey area and the possible UST onto the NCDOT MicroStation engineering plans for reference.

SUMMARY & CONCLUSIONS

Pyramid's evaluation of the EM61 and GPR data collected at Parcel 1 in Charlotte, North Carolina, provides the following summary and conclusions:

- The EM61 and GPR surveys provided reliable results for the detection of metallic USTs within the accessible portions of the geophysical survey area.
- A metal anomaly associated with a concrete pad was suspected to be the result of metal reinforcement in the concrete, but was investigated with GPR to verify. Three other metallic features were also investigated with GPR.
- GPR verified the presence of metal reinforcement in the concrete pad.

- GPR provided evidence of an isolated, discreet lateral reflector in the central portion of the survey area that is characteristic of a structure such as an oil-water separator UST. The combined geophysical data resulted in this feature being classified as one possible metallic UST (center point: 1448878, 545047, North Carolina State Plane NAD83, feet).
- The possible metallic UST was approximately 9 feet long and 3 feet wide, located directly below the asphalt subgrade.
- The remaining geophysical data provided evidence of a possible utility east of the possible UST, and an area containing suspected metallic debris.
- Collectively, the geophysical data recorded evidence of one possible metallic UST at Parcel 1.

LIMITATIONS

Geophysical surveys have been performed and this report was prepared for the NCDOT in accordance with generally accepted guidelines for EM61 and GPR surveys. It is generally recognized that the results of the EM61 and GPR surveys are non-unique and may not represent actual subsurface conditions. The EM61 and GPR results obtained for this project have not conclusively determined the definitive presence or absence of metallic USTs, but the evidence collected is sufficient to result in the conclusions made in this report. Additionally, it should be understood that areas containing extensive vegetation, reinforced concrete, or other restrictions to the accessibility of the geophysical instruments could not be fully investigated.

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APPROXIMATE BOUNDARIES OF GEOPHYSICAL SURVEY AREA

View of Survey Area
(Facing Approximately Southeast)

View of Survey Area
(Facing Approximately East)

TITLE
PARCEL 1 - GEOPHYSICAL SURVEY
BOUNDARIES AND SITE PHOTOGRAPHS

PROJECT
PARCEL 1
NCDOT PROJECT P-5705B (WBS 44475.1.2)
CHARLOTTE, NORTH CAROLINA

PYRAMID GEOPHYSICS
503 INDUSTRIAL AVENUE
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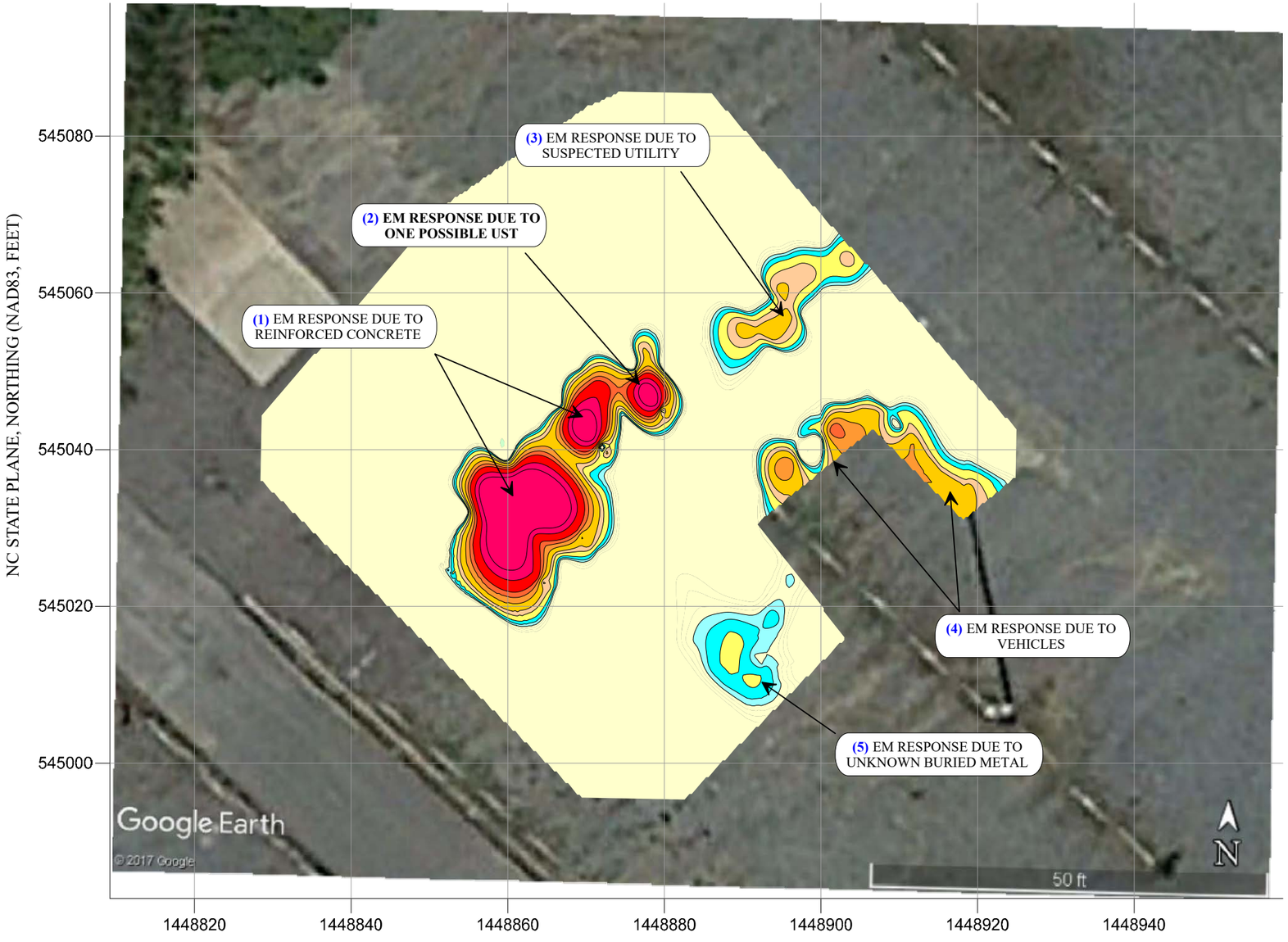
License # C1251 Eng. / License # C257 Geology

DATE 9/13/2017	CLIENT NCDOT
PYRAMID PROJECT #: 2017-253	**FIGURE 1**

N

EM61 METAL DETECTION RESULTS



EVIDENCE OF ONE POSSIBLE METALLIC UST OBSERVED.

The contour plot shows the differential results of the EM61 instrument in millivolts (mV). The differential results focus on larger metallic objects such as USTs and drums. The EM61 data were collected on August 26, 2017, using a Geonics EM61 instrument. Verification GPR data were collected on August 27-29, 2017, using a GSSI UtilityScan DF unit with a dual frequency 300/800 MHz antenna.

EM61 Metal Detection Response (millivolts)

TITLE	PARCEL 1 - EM61 RESULTS CONTOUR MAP
PROJECT	PARCEL 1 NCDOT PROJECT P-5705B (WBS 44475.1.2) CHARLOTTE, NORTH CAROLINA
PYRAMID GEOPHYSICS	503 INDUSTRIAL AVENUE GREENSBORO, NC 27460 (336) 335-3174 (p) (336) 691-0648 (f) License # C1251 Eng. / License # C257 Geology
DATE 9/13/2017	CLIENT NCDOT
PYRAMID PROJECT #: 2017-253	**FIGURE 2**

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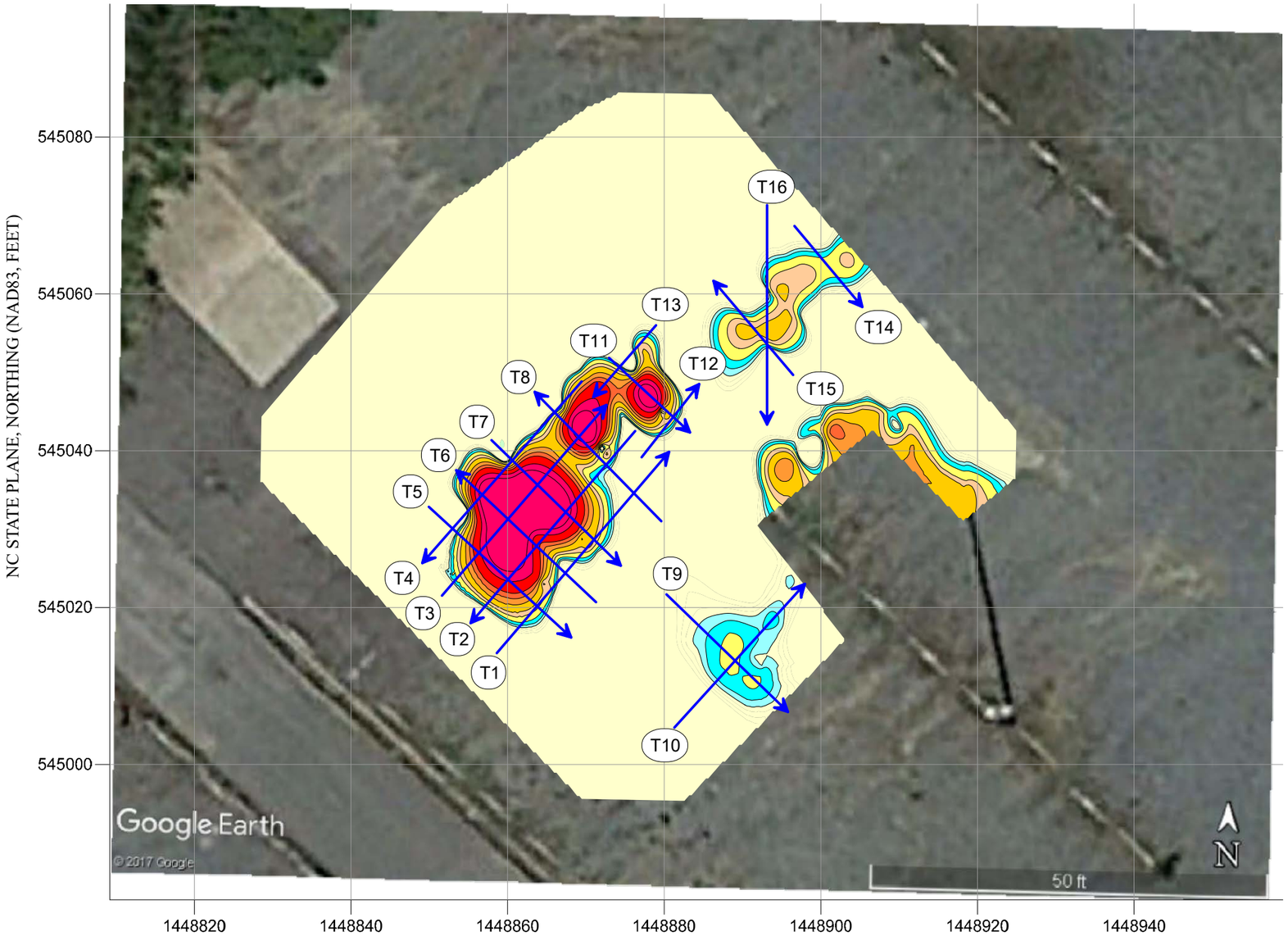
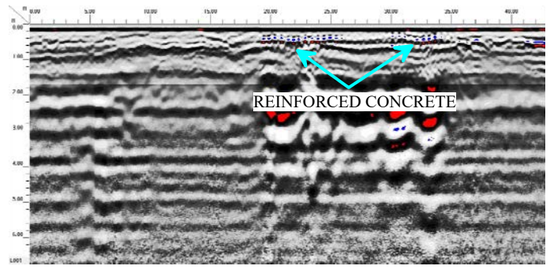
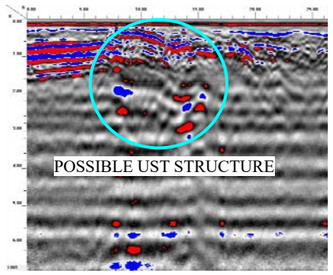
GPR TRANSECT LOCATIONS





GPR TRANSECT 2 (T2)



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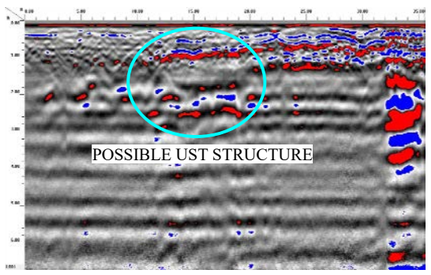

GPR TRANSECT 12 (T12)

TITLE	PARCEL 1 - GPR TRANSECT LOCATIONS AND SELECT IMAGES
PROJECT	PARCEL 1 NCDOT PROJECT P-5705B (WBS 44475.1.2) CHARLOTTE, NORTH CAROLINA
PYRAMID GEOPHYSICS	503 INDUSTRIAL AVENUE GREENSBORO, NC 27460 (336) 335-3174 (p) (336) 691-0648 (f) License # C1251 Eng. / License # C257 Geology
DATE: 9/13/2017	CLIENT: NCDOT
PYRAMID PROJECT #: 2017-253	**FIGURE 3**

N

LOCATION OF POSSIBLE METALLIC UST

View of Possible UST #1
Facing Approximately Southeast

TITLE	PARCEL 1 - LOCATION AND SIZE OF POSSIBLE UST
PROJECT	PARCEL 1 NCDOT PROJECT P-5705B (WBS 44475.1.2) CHARLOTTE, NORTH CAROLINA
PYRAMID GEOPHYSICS	503 INDUSTRIAL AVENUE GREENSBORO, NC 27460 (336) 335-3174 (p) (336) 691-0648 (f) License # C1251 Eng. / License # C257 Geology
DATE 9/13/2017	CLIENT NCDOT
PYRAMID PROJECT #: 2017-253	**FIGURE 4**

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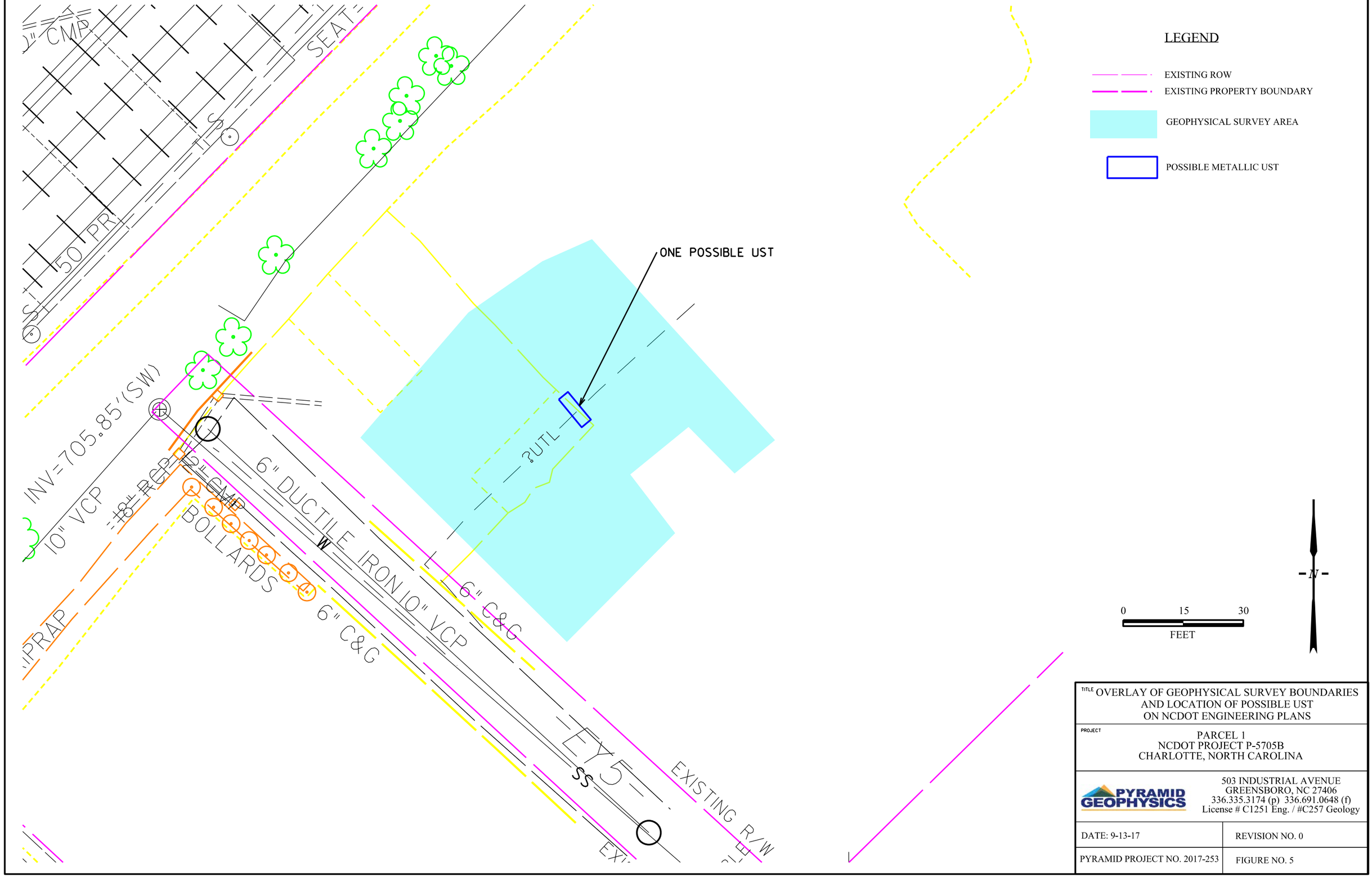

TITLE OVERLAY OF GEOPHYSICAL SURVEY BOUNDARIES AND LOCATION OF POSSIBLE UST ON NCDOT ENGINEERING PLANS

PROJECT
PARCEL 1
NCDOT PROJECT P-5705B
CHARLOTTE, NORTH CAROLINA

PYRAMID GEOPHYSICS
503 INDUSTRIAL AVENUE
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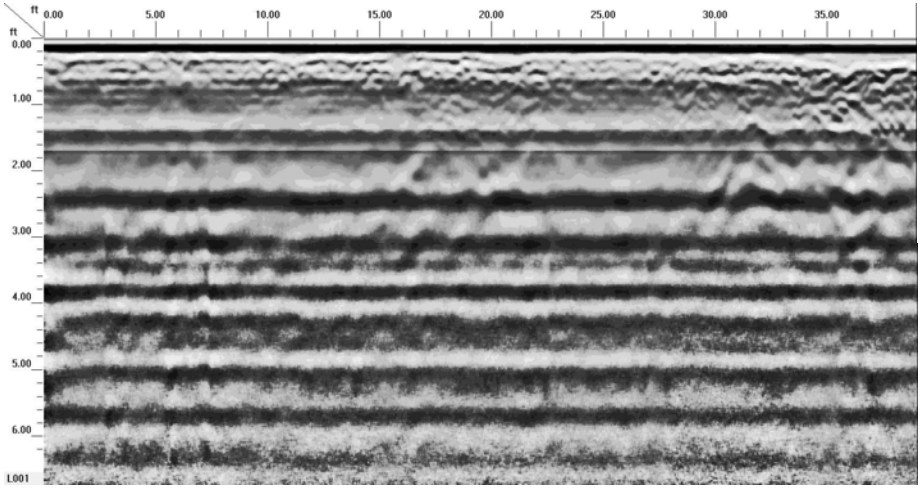
DATE: 9-13-17	REVISION NO. 0
PYRAMID PROJECT NO. 2017-253	FIGURE NO. 5

Appendix A – GPR Transect Images



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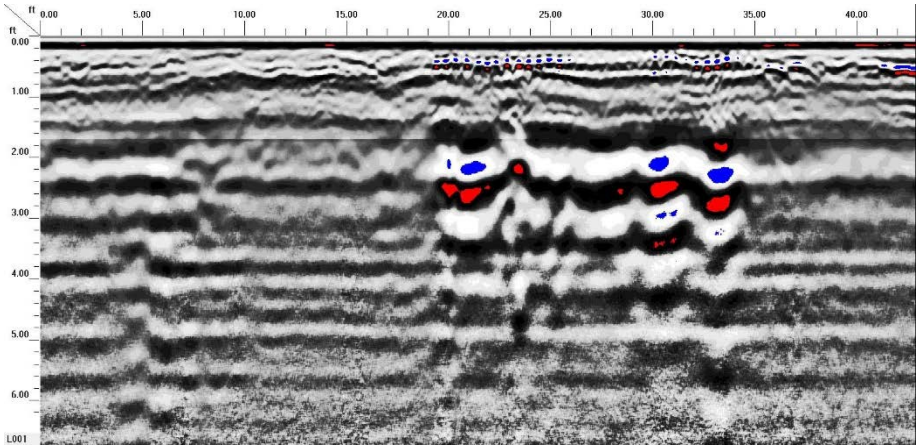

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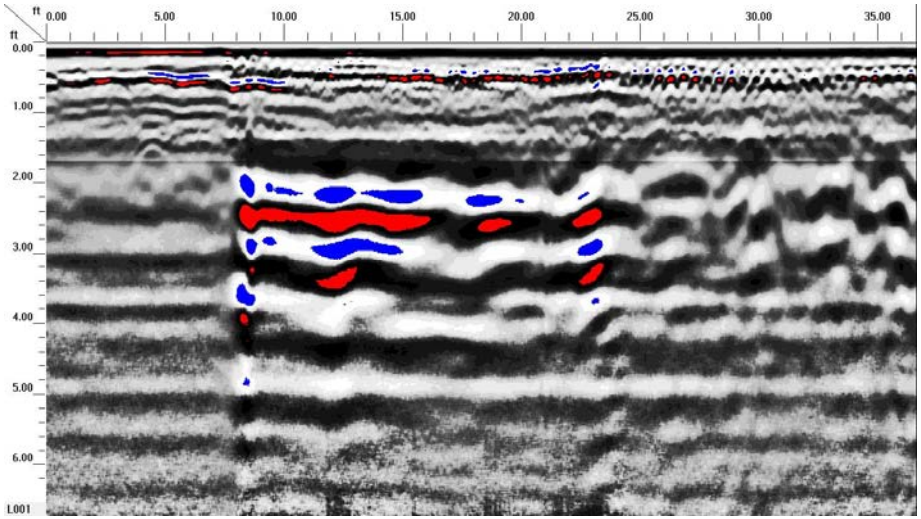

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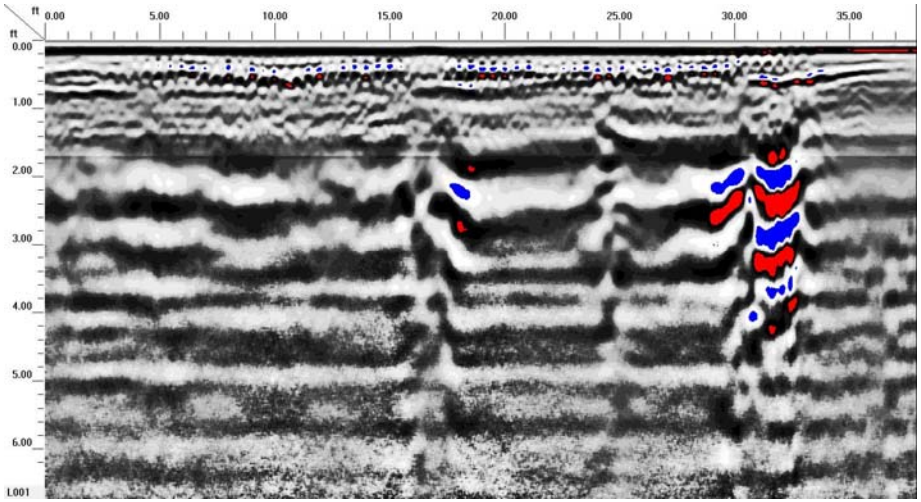

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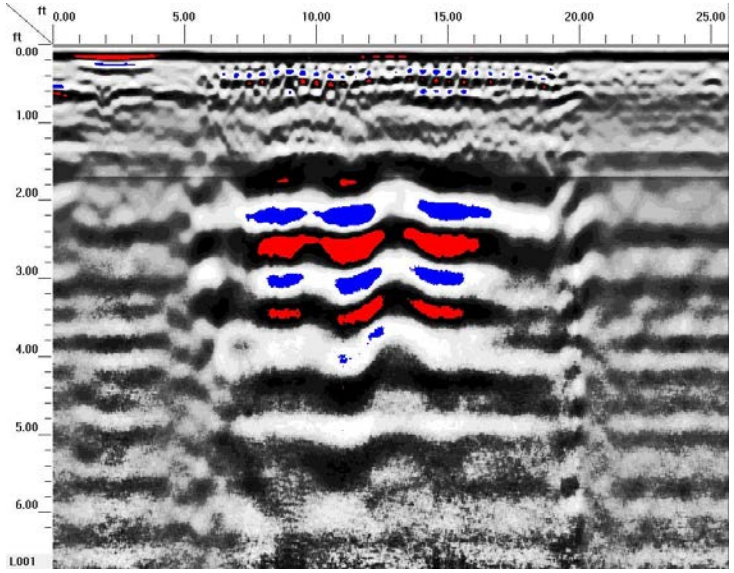

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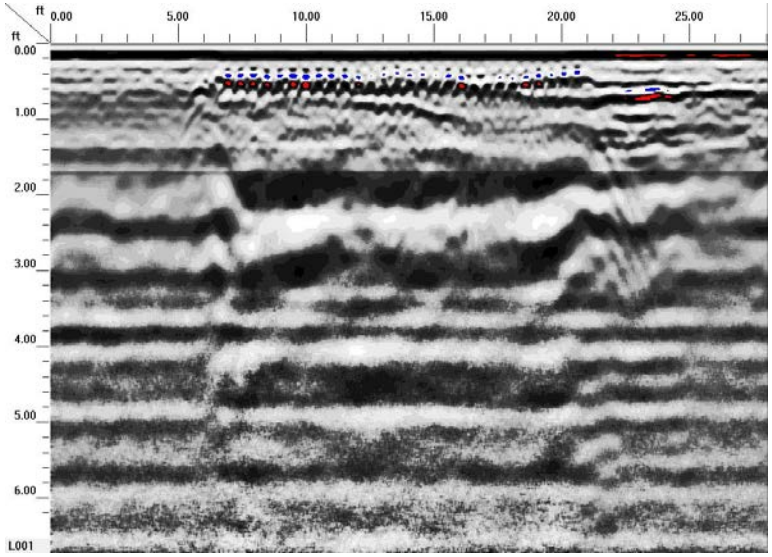

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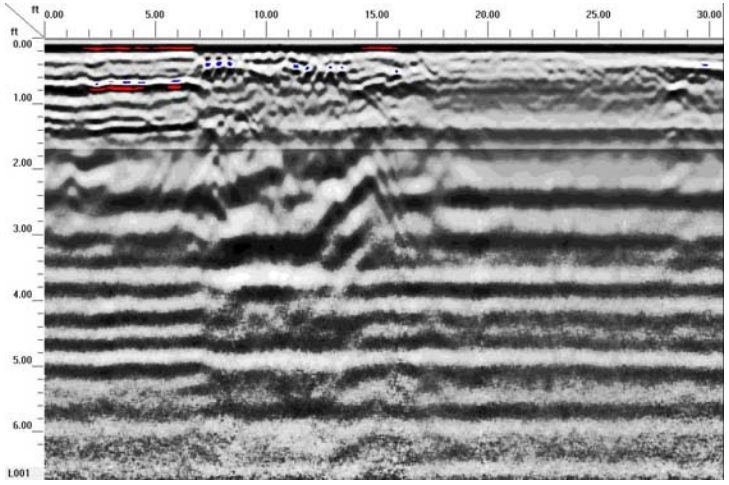

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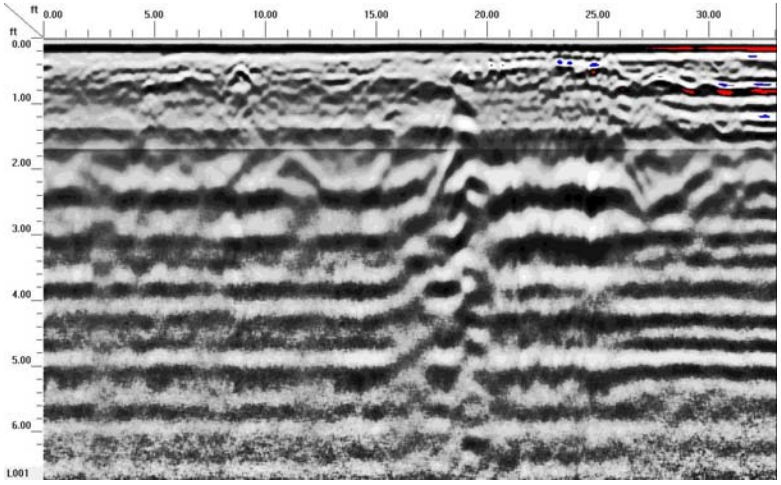

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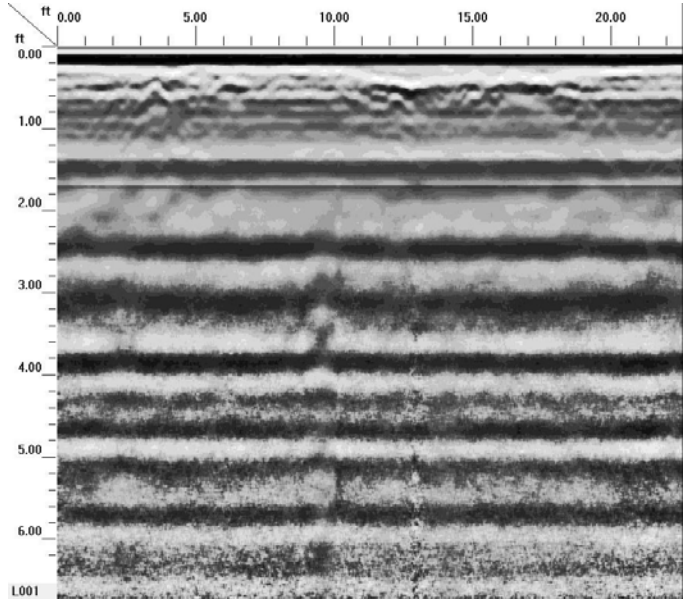

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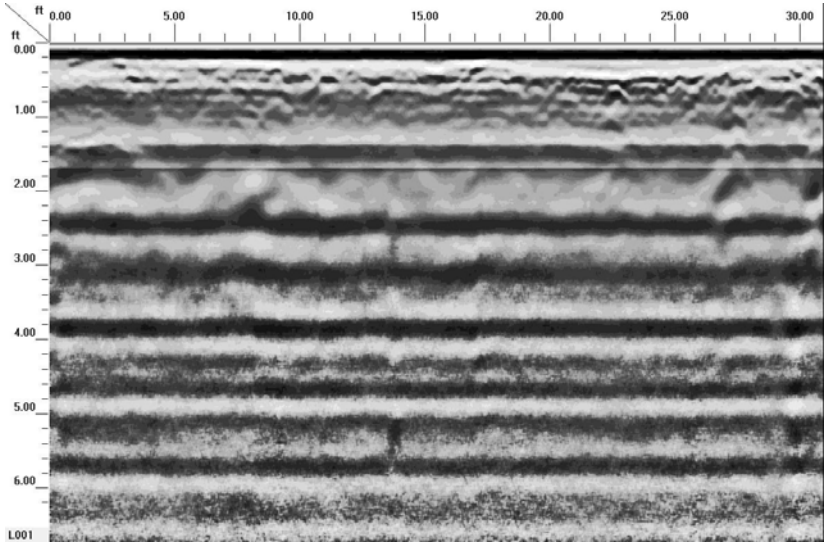

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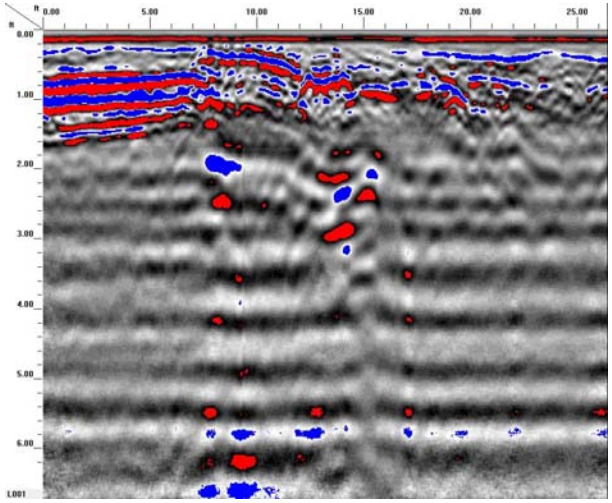

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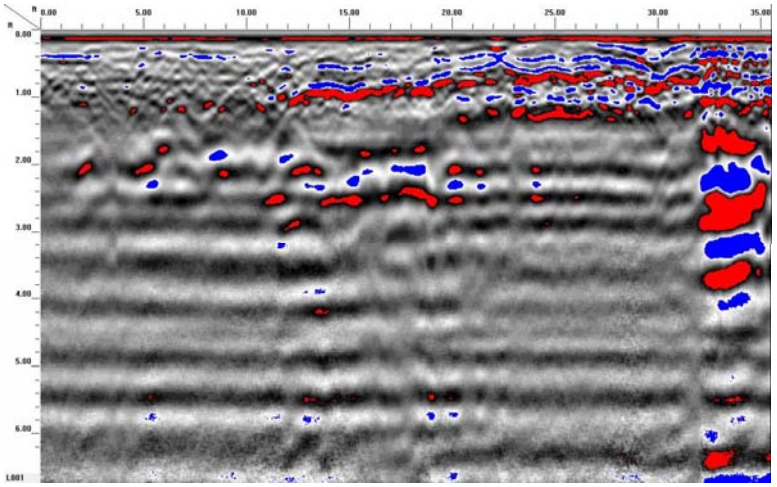

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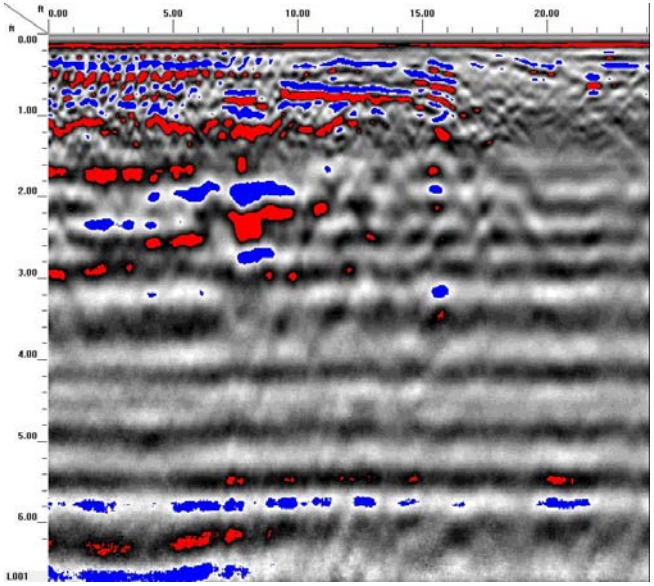

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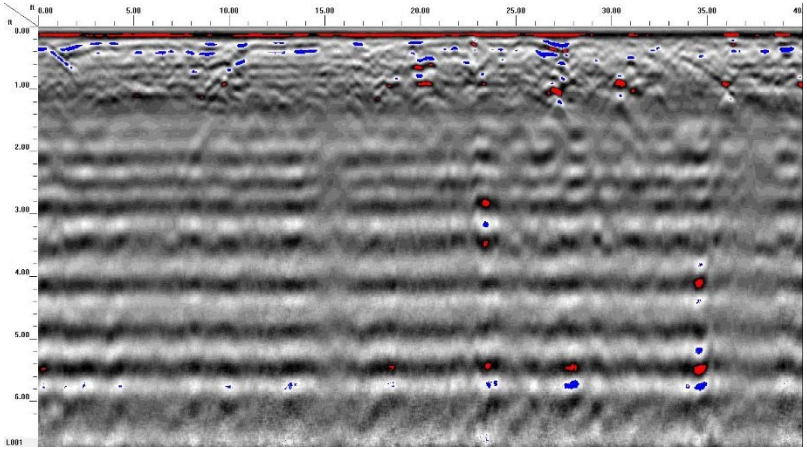

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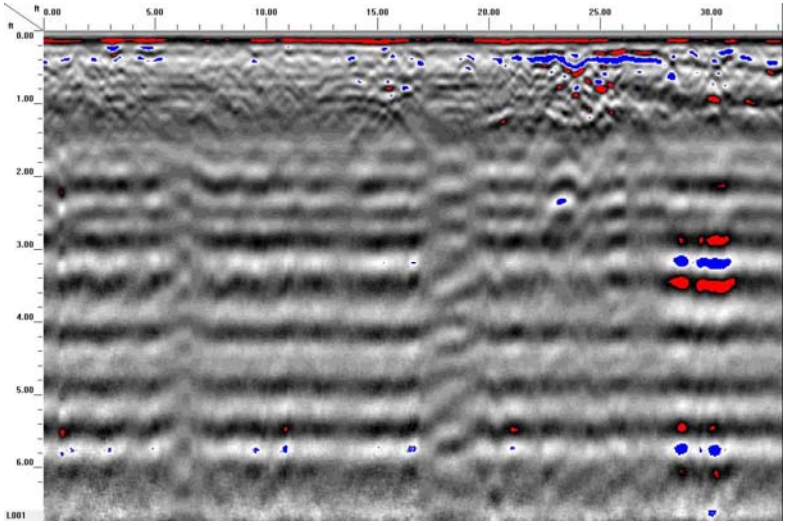

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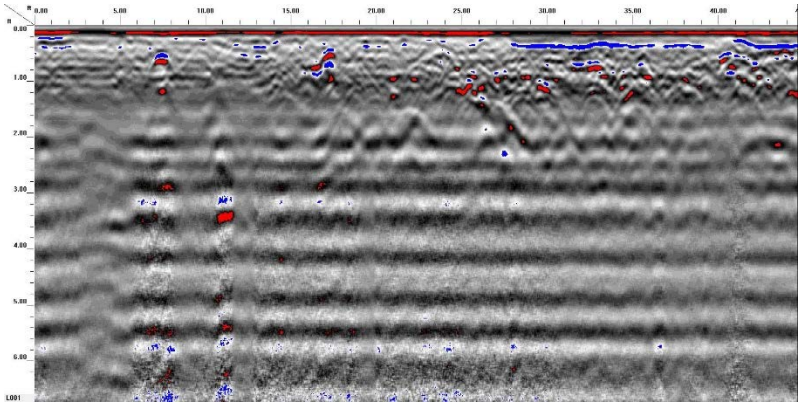

GPR TRANSECT 16